

# The 'one health' approach

**Infectious pathogens harboured by wildlife are a threat to both human and animal health – Institute researchers are finding solutions.**

Over recent decades, there has been a growing realisation of the importance of infectious agents (or pathogens) harboured by wildlife, and their effects on both wildlife populations and public health (Cunningham et al. 2017).

Although wildlife pathogens have caused disease in wild animals for millennia, human activities are increasingly enabling these to become a conservation threat. This can be through the reduction in size of wild animal populations to a level where disease becomes significant to their survival or, more dramatically, when people (usually inadvertently) transport pathogens to new areas, exposing and infecting populations and species that have not naturally evolved with the infection. As people move wild animals and wild animal products, and therefore wild animal pathogens, in increasing volumes and at greater speeds around the world, disease is occurring – and being recognised as a growing threat to species conservation (Cunningham et al. 2017).

It is not just wild animals that are at risk from wildlife pathogens. These diseases can cross over into other species, including livestock and people (Cunningham et al. 2017). Indeed, as we have learned to combat and control diseases natural to human beings – as well as those such as measles that we acquired from our food and companion animals around the time of domestication – we are faced with the prospect of dealing with new diseases spilling over into people from wildlife. Such spillover has been ever present, but as we encroach further into remaining wildlife habitats, and as we interact with many previously ignored

species (for example, turning to bats for bushmeat in the absence of larger animals that have been depleted due to overhunting), our exposure to new wildlife pathogens has increased.

At the same time, motorised transport and increased human population densities provide new opportunities for human-to-human transmission and spread of novel pathogens. Infected people are now able to reach towns, cities and hospitals prior to recovery or death, and the volume and speed of international travel allows pathogens to spread even before the first signs of disease are detected.

## Tackling the root of the problem

Clearly, these two issues, of disease threats to wildlife conservation and to public health, are interconnected and require a common mitigation approach that tackles the root of the problem (Cunningham et al. 2017). Such an approach, often termed 'one health', 'ecohealth' or 'planetary health', has been a key focus of Institute research for many years, and it is gaining public and political attention.

We have a long and successful history of diagnosing where disease is a conservation threat, identifying the causes and underlying drivers of such diseases, and developing mitigation methods in captivity and in the wild.

For example, in the 1990s, the Institute led the international consortium of scientists who discovered the non-hyphal chytrid fungus *Batrachochytrium dendrobatidis* as a cause of amphibian disease, and showed that this disease is causing multi-species amphibian population declines and extinctions globally (Berger et



al. 1998). In the UK, our researchers recently discovered finch trichomonosis, caused by the protozoan parasite jumping from pigeons and doves to finches, and showed this is causing sudden and rapid population declines of the greenfinch (*Chloris chloris*) (Lawson et al. 2012).

## Minimising the risk of spillover

From a public health perspective, our research aims to understand the host-pathogen-human system, including the ecology of the pathogen in nature. Knowledge of pathogen infection dynamics in the natural host(s) can be used to inform the modification of human behaviours to minimise zoonotic spillover risk. Working collaboratively with social scientists is often essential to understanding human behaviours and motivations and how to implement solutions (Wood et al. 2012).

Our work in this field is exemplified by research to understand the significance of badgers (*Meles meles*) as hosts of bovine tuberculosis and the factors that increase the likelihood of spillover to livestock (and eventually to people). Institute scientists and

collaborators found that the control measure of proactive culling of badgers actually increases the rate of spread and likelihood of spillover; an important result for informing mitigation measures that will actually work (Bielby et al. 2014).

## Public health risks

In collaboration with the University of Cambridge, we have carried out a 10-year study into the ecology of viral pathogens carried by West African fruit bats, such as the straw-coloured fruit bat (*Eidolon helvum*). Fruit bats are often termed 'keystone species' because of their importance for the maintenance of ecosystem structure and function. Without these bats dispersing seeds and pollinating forest and orchard trees, our diet would be depleted of many fruits, and tropical forests would fail to regenerate in their current form.

By understanding the ecology of pathogens such as rabies and Ebola viruses in their natural bat hosts, and the interactions between bats and people that lead to human infection, we hope to find ways of minimising public health risks – allowing bats and

humans to coexist (Wood et al. 2012; Wood et al. 2016). Future work in this area will include research to better understand the impacts of viral infections on the bats and how these infections can persist over time in their host populations.

'One health' was the subject of a special issue of the journal *Philosophical Transactions of the Royal Society B: Biological Sciences*, published in June 2017 and edited by the Institute's Andrew Cunningham along with Ian Scoones (Institute of Development Studies) and James Wood (University of Cambridge). This special issue, entitled *One Health for a changing world: zoonoses, ecosystems and human well-being*, brought together a wide range of natural and social scientists to examine how well one health is working for conservation, livestock and public health, where it is failing and to identify priorities for further research. All papers in the special issue are available free online at [rspb.royalsocietypublishing.org/content/372/1725](http://rspb.royalsocietypublishing.org/content/372/1725).



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